Blade Vibration Measurement System for Characterization of Closely Spaced Modes and Mistuning, Phase II

Completed Technology Project (2009 - 2013)

Project Introduction

The Phase I project successfully demonstrated that the advanced non-contacting stress measurement system (NSMS) was able to address closely spaced modes and blade-to-blade variations (mistuning). MSI's advanced NSMS method uses a radar-based blade vibration measurement system with the following capabilities: • Provides a continuous time series of blade displacement data over a portion of a revolution (solving the under sampling problem). • Includes data reduction algorithms to directly calculate the blade vibration frequency, modal displacement, and vibratory stress (solving the mode inference problem). • Uses a single sensor per stage to monitor all of the blades on the stage. The Phase II work begins by confirming the sensor calibration process, modifying the sensor module so it is compatible as an upgrade to existing NSMS system, and improving and finalizing the NSMS software. The result will be a stand-alone radar/tip timing radar module for current conventional NSMS users (as an upgrade) and new users. The hybrid system will use frequency data and relative mode vibration levels from the radar sensor to provide substantially superior capabilities over current blade vibration technology. This frequency data, coupled with a reduced number of tip timing probes, will result in a system capable of detecting complex blade vibrations which would confound traditional NSMS systems. The hardware and software package will be validated on an existing compressor rig at MSI. Finally, the hybrid radar/tip timing NSMS software package and associated sensor hardware will be installed for use in the NASA GRC spin pit test facility. MSI will also supply the stand-alone radar module to a major engine prime.

Primary U.S. Work Locations and Key Partners

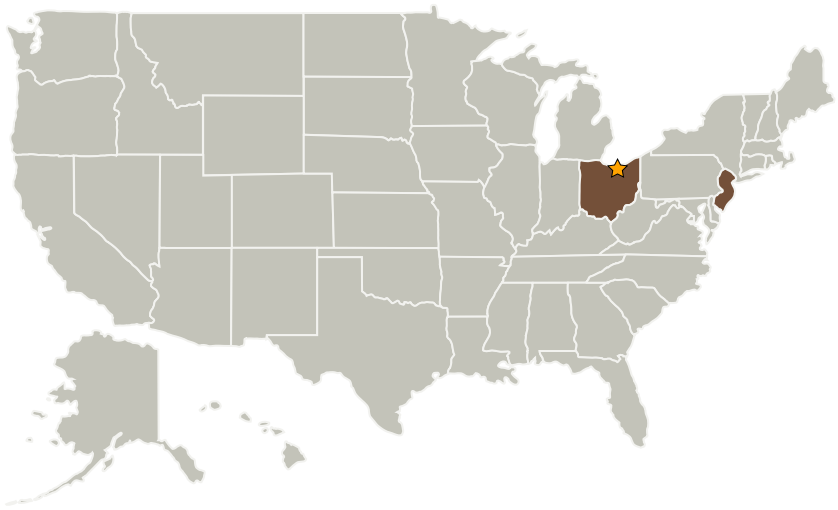

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Mechanical Solutions, Inc.	Supporting Organization	Industry	Whippany, New Jersey

Primary U.S. Work Locations	
New Jersey	Ohio

Project Transitions

January 2009: Project Start

March 2013: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.4 Information Processing
    - TX11.4.2 Intelligent Data Understanding